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(54) **Detergent container closure for use in automatic feed systems**

(57) A water-soluble film closure 4 is provided for the opening 2 of a detergent container 1 utilised in an automatic detergent feed system, whereby the powdered detergent in the container is sealed from exposure to atmospheric moisture and other contaminants, and from sifting and spillage, while at the same time being readily removed by the water jet or pulse of the automatic feed system, thus completely avoiding any human contact with the powdered detergent in the container.

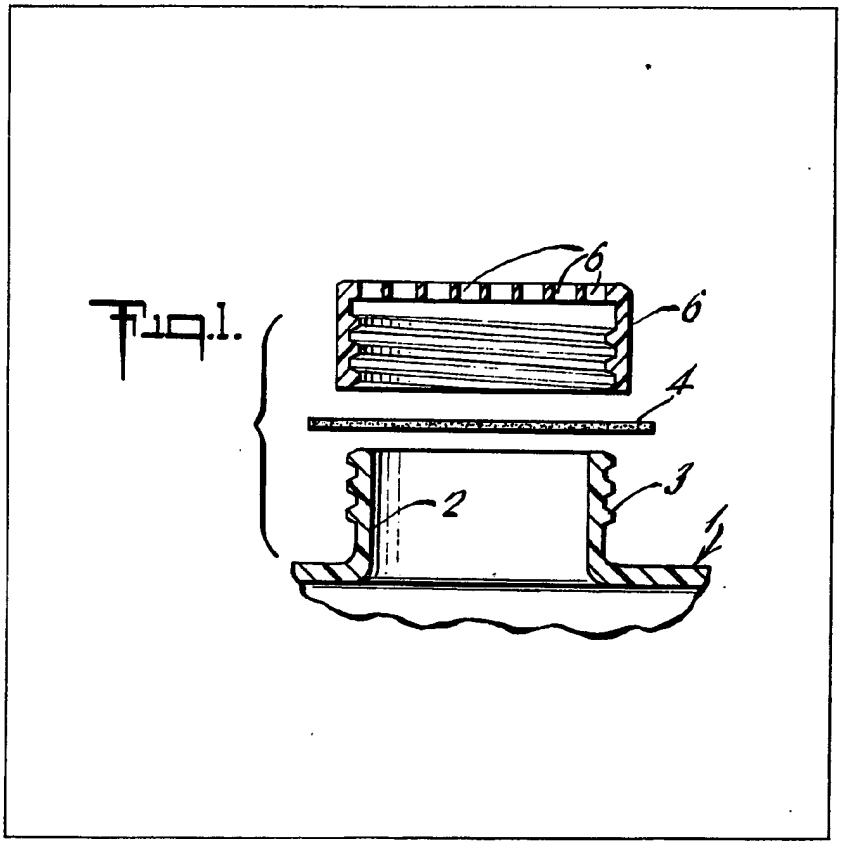

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Fig.1.

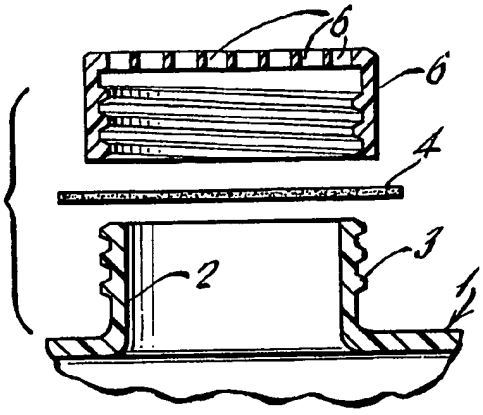


Fig.2.

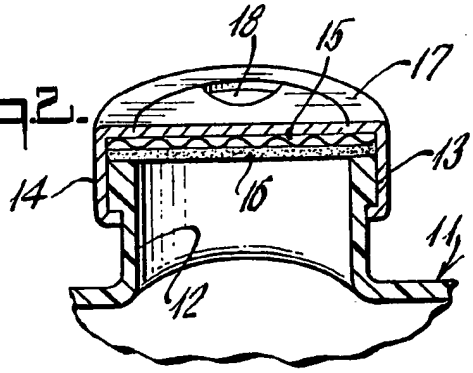


Fig.3.

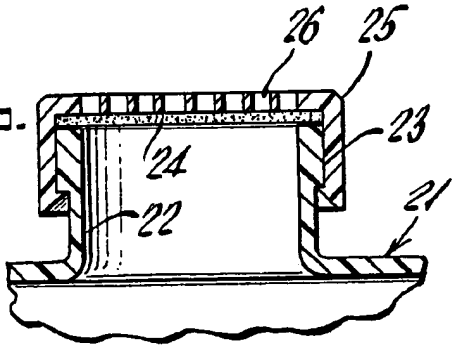


Fig.4.

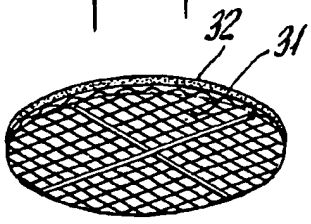
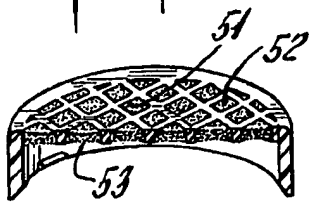


Fig.5.



SPECIFICATION

Detergent container closure for use in automatic feed systems

The present invention is concerned with a film closure for a container of powdered detergent to be utilised in an automatic feed system.

Closures for containers of powdered detergent utilised in an automatic feed system which have been in use heretofore have consisted primarily of either simple cap-type closures secured to the container opening by frictional or threaded engagement, or else have consisted of a removable tape adhesively secured to the container opening. Such previously used closure means, however, often result in sifting of the powdered detergent through the container opening after the closure means is removed, resulting in unwanted spillage. Also, since the container for the powdered detergent must be inverted when being installed in the automatic detergent feed system, but can only be opened in an upright position, spillage of the powdered detergent is very difficult to avoid.

Summary of the invention:

Automatic detergent feed systems are widely used today in many commercial and institutional facilities requiring warewashing on a large scale, for example laboratories, hospitals, cafeterias and restaurants. Two especially efficient systems of this type are the CCS-3000 and Penny Pincher® automatic detergent feed systems manufactured by Calgon Corporation, Saint Louis, Missouri. See U.S. Patent No. 3,850,344 for a description of such systems.

In the typical automatic detergent feed system of this type, the detergent is periodically dispensed to the wash unit as a solution/slurry produced by repeated jets or pulses of water which are directed against and into the bottom opening of a container in which the powdered detergent to be dispensed is retained. Such a container is provided with a single opening and the container is inverted when installed in the automatic feed system so that the jets or pulses of water are directed upwardly against and into the opening. The opening of the container is usually provided with a screen which acts to both partially retain the detergent within the container and to break up and disperse the jets or pulses of water so that the water more uniformly contacts the detergent within the container. As the detergent is dissolved and mechanically removed by the water to form a solution/slurry, more powdered detergent within the container moves downwardly, by gravity, into the proximity of the container opening, ready for contact with the next jets or pulses of water. The jets or pulses of water, in turn, and thus ultimately the amount of detergent dispensed to the wash unit, are controlled by means including a sensor to determine the concentration of detergent in the wash unit, and means for controlling the flow of water responsive to changes in detergent concentration as determined by the sensor means.

The powdered detergent itself may be of a number of different formulations, which may include a number of different additives. Essentially, any powdered detergents usable in the automatic detergent feed systems described herein are included.

The term 'screen' herein means a sieve of suitable mesh.

Once the supply of powdered detergent in the container is depleted, a sensor means indicates the need for replacement, and the empty detergent container is removed and a full one is installed in its place. Since such detergent containers are utilised in the automatic feed system in an inverted position, it has been a longstanding problem as to how to open such containers and then invert and install them in the automatic feed system without spilling some of the detergent in the container, which will often occur despite the partial retaining action of the screen. In addition to waste, such spillage can cause alkaline burn on the equipment of the automatic feed system.

In accordance with the present invention, a container of powdered detergent for installation in an automatic detergent feed system, the said container being filled with detergent, having an opening in the top with a screen over it, and being inverted when installed in the automatic feed system, is provided with a water-soluble film closure over the opening of the detergent container. The water-soluble film closure may be incorporated into the features of standard closure means, and this is preferred since the water soluble film will ordinarily not possess sufficient tear and puncture resistance to be used by itself as a closure means *per se*.

The detergent container closure of the present invention provides a unique means of reducing or avoiding spillage problems when the detergent container is inverted for use, while at the same time sealing the powdered detergent from exposure to atmospheric moisture and other contaminants during shipment and storage.

The water-soluble film closure may simply take the form of a square or other conveniently shaped film of water-soluble material of suitable dimensions which is placed over the opening of a detergent container, which is formed by a neck portion having a threaded exterior portion. Then, a protective cap having an interior threaded portion is placed over said square or other conveniently shaped film and engaged to said neck portion by rotating. The film of water soluble material is thereby secured to the opening of the detergent container, and is protected from injury by the protective cap engaged to the neck portion of the detergent container, over said film. The protective cap is further provided with a screen, whose function has been described above. This screen is preferably and most conveniently formed into the top portion of the

cap as an integral part thereof when the cap is molded. However, the screen may be a separate piece which is then inserted into the cap. Thus, in this arrangement, the screen, forming the top portion of the cap, is fitted securely over the film of water soluble material when the cap is engaged to the neck portion of the container. In this way, the detergent container may be installed in the automatic feed system without any closure removal whatever, the screen having played a role in protecting the water soluble film material, while at the same time being available for functioning in its usual role.

The water soluble film closure may also take the form of being incorporated into a crimped or friction fitted closure. In such an arrangement, the film of water soluble material and then the screen placed over it, are secured to the opening of the detergent container by a ring of suitable material clamped or otherwise secured around the opening of the detergent container, which may be provided with a flange to facilitate attachment. Optionally, a protective cap is then engaged to the ring which has been attached around the container opening. This engagement may be by means of a friction fitting. It is also possible to have the protective cap, and the ring used to secure the screen and film of water soluble material over the container opening, formed from a single piece of material, and so made that the protective cap may be separated and removed, while leaving in place the ring used to secure the screen and film of water soluble material over the container opening.

In another embodiment of the present invention, the water soluble film closure may take the form of a film of water soluble material having the same dimensions as the detergent container opening and bonded to the outer edge of that opening so as to be thereby sealed over it. The bonding may be accomplished by means of a suitable adhesive, for example, or by means of a heat fusion technique. The screen may be placed, beneath, or, preferably, above and over the water soluble film. This embodiment may be adapted to be utilized with the standard closure means described above.

In yet another embodiment, the film of water soluble material may be adhesively affixed or otherwise bonded, as for example by heat fusing, to either side of the screen, and this single unit may then be incorporated into the features of standard closure means, as described above. It is also contemplated that the water soluble material may be melted, or made into a solution or suspension, which can then be applied to the screen so as to form a water soluble film bonded to said screen.

In a particularly preferred embodiment of the present invention, the protective cap with topmost portion formed as the screen, is made from a material which repels the water soluble material, for example a polyolefin, especially polyethylene, and the water soluble material is applied thereto as a melt. The respective characters of the polyolefin and water soluble material are thus such that the water soluble material is repelled from the polyolefin surface of the screen and is thus left to occupy only the openings of the screen. When the molten water soluble material solidifies, it blocks or occludes only the openings of the polyolefin screen and is not coated on the top surface of the screen. In this way, the screen can readily perform its usual function, as described above, while at the same time affording satisfactory protection to the film of water-soluble material. While the film is essentially non-continuous in this case, it is included here within the meaning of the general term 'film'.

For use in the present invention, any water-soluble material is suitable which can be formed into a discrete film usable in making a closure for the opening of a detergent container to be utilised in an automatic detergent feed system. For example, the following water soluble materials may be employed: polyvinyl alcohol, polyethylene glycol or methoxy polyethylene glycol having a molecular weight of 1300 to 15,000, polyethylene oxide, hydroxyethyl cellulose, carboxymethyl cellulose, and various organic surface-active agents. A number of other water-soluble materials would suggest themselves to the artisan of ordinary skill as being suitable for use in the present invention, and these are included as well.

The thickness of the film of water-soluble material is not critical and is formed to depend upon the water-solubility characteristics of the material as well as upon the strength characteristics of the film made from the water-soluble material. Generally, a film thickness between 1 and 10 mils has been found suitable, and preferably the film thickness is about 1 to 4 mils.

The present invention is illustrated by the drawings in which:

Figures 1, 2 and *3* show different methods of closure of a container, all of which embodying the invention; *Figures 4* and *5* show different types of screen for use in closing a container in accordance with the invention.

Figure 1 depicts the water soluble film closure as a separate film to be secured over the detergent container opening by means of a protective cap having threaded engagement to the neck portion of the container forming the opening. This Figure shows the portion of a detergent container *1* containing the opening *2* which is formed by a neck portion *3* having a threaded exterior. A shaped film *4* of water soluble material is placed over the opening *2*, and a protective cap *5* having a screen *6* in the top thereof is placed over square film *4* and then engaged to neck portion *3* by rotating.

Figure 2 of the drawings depicts a friction fitted closure with a screen and water soluble film secured over the container opening by means of a ring attached around the opening. This Figure shows a detergent container *11* containing the opening *12* which is formed by a flange *13*. A ring *14* is fitted over flange *13* and secures in place a film of water soluble material *15* and screen *16*. A protective cap *17* is formed from the same piece of material as ring *14* and the indent *18* in that piece of material will allow the cap *17* to be separated and removed, leaving in place the ring *14*.

Figure 3 depicts the film of water soluble material bonded over the container opening. This Figure shows a

detergent container *21* containing the opening *22* which is formed by neck portion *23*. A film *24* of water soluble material has been bonded to the outer edge of neck portion *23* and over the opening *22*. A protective cap *25* having a screen *26* in the top thereof can then be friction fitted over neck portion *23*.

Figure 4 depicts the film of water soluble material bonded over a screen. This Figure shows the screen *31* to which is bonded the film *32* of water soluble material.

Figure 5 depicts a screen made from a material which repels the water soluble material, openings of which are occluded by the water soluble material, applied as a melt. This Figure shows a portion of a screen *51*, whose openings *52* are filled with the water soluble material *53*. The screens of Figures 4 and 5 may be employed as single units to be incorporated into the features of the standard closure means depicted in the other Figures, but they are also illustrative of screens forming integral parts of closure means as described herein.

Example

A polyvinyl alcohol (PVA) film closure was evaluated on Kleer N'Kleen® detergent containers used in a Penny Pincher® automatic detergent feed system manufactured by Calgon Corporation, Saint Louis, Missouri. A Calgomatic VI® control was utilized with the feed system, and the evaluation was carried out in hot and cold water with the following results:

	Hot Water	Cold Water
Water Temperature	135°F.	70°F.
Water Pressure	10 psi	10 psi
PVA Seal Dissolve Time	15 sec.	15 sec.
Calgomatic ® Control Wash Unit: Concentration of Detergent	0.35%	0.35%
Feed Slurry: Concentration of Detergent	6.0%	2.75%

These results indicate that the polyvinyl alcohol film closure dissolved adequately when utilized in an automatic detergent feed system.

CLAIMS

1. A container for powdered detergent for installation in inverted position in an automatic detergent feed system, the said container having an opening in the top with a screen and a water-soluble film closure over it.

2. A container as claimed in Claim 1 in which the water-soluble film is made of polyvinyl alcohol, polyethylene glycol or methoxy polyethylene glycol having a molecular weight of 1300 to 15,000, polyethylene oxide, hydroxyethyl cellulose, carboxymethyl cellulose, or an organic surface-active agent.

3. A container as claimed in Claim 1 or 2 in which the screen is placed over the water-soluble film closure.

4. A container as claimed in Claim 3 in which the screen is the topmost portion of a protective cap engaged to the container about the opening in it.

5. A container as claimed in Claim 1 or Claim 2 in which the screen and the water-soluble film closure are bonded together.

6. A container as claimed in Claim 5 in which the screen is made from a material that repels the water-soluble material from which the water-soluble film closure is made, and the openings only of the screen are filled with the water-soluble material.

7. A container for powdered detergent for installation in an automatic detergent feed system, comprising, in combination, a container with one opening in it, a water-soluble film covering the said opening, and attached to the container, covering the film and opening, a protective cap, the topmost portion of which is a screen.

8. A container as claimed in claim 7 in which the water-soluble film is made of polyvinyl alcohol, polyethylene glycol or methoxypolyethylene glycol having a molecular weight of 1300 to 15,000, polyethylene oxide, hydroxyethyl cellulose, carboxymethyl cellulose, or an organic surface-active agent.

9. A container for powdered detergent for installation in an automatic detergent feed system, comprising, in combination, a container with one opening in it and, covering the opening, a protective cap attached to the container about the said opening, the topmost portion of the cap comprising a screen and a water-soluble material filling only the openings of the screen, the screen being made from a material that repels the water-soluble material.

10. A container as claimed in any preceding claim, containing powdered detergent.

11. A container for powdered detergent for installation in inverted position in an automatic detergent feed system and having in the top an opening substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings.

12. A container for powdered detergent for installation in inverted position in an automatic detergent feed system and having in the top an opening substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

13. A container for powdered detergent for installation in inverted position in an automatic detergent feed system and having in the top an opening substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

14. A container for powdered detergent for installation in inverted position in an automatic detergent feed system and having at the top a closure means substantially as hereinbefore described with reference to Figure 4 or 5 of the accompanying drawings.

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